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Diatoms from the Mark Sand Prairie, Black Hawk County, Iowa

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Diatoms from the Mark Sand Prairie, Black Hawk County, Iowa[1]

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A total of 107 diatom taxa representing 22 genera was identified from four microhabitats in a northerly facing wet swale in the Mark Sand Prairie. One of these was a *Sphagnum* polster. Chemical analyses of water from these microhabitats showed that none exceeded 60 ppm total hardness (as $CaCO_3$). Fifteen taxa are new records for Iowa. A brief comparison is made between the diatom flora of this site and that of another soft water site, the *Sphagnum* bog located in Pilot Knob Preserve (Hancock County, Iowa).
INDEX DESCRIPTORS: Diatoms, Sand Prairies, *Sphagnum* bogs, Black Hawk County, Iowa.

In the summer of 1969 a 14.6ha sand prairie (privately preserved and locally known as the Mark Sand Prairie) was discovered in Black Hawk County, Iowa (T 90N, R 14W, Sec. 19, NW 1/4). Crum (1972) described the site and its vascular flora. During his investigation, Crum found several polsters of *Sphagnum* sp. occurring in a northward sloping wet swale occupying approximately ⅓ of the site. Samples from these proved to contain an interesting assemblage of diatoms. My study was made to further explore the diatom flora of the swale and to make a brief comparison with that of the Pilot Knob Bog, Hancock Co., Iowa (Christensen 1969, 1976, 1981; Dodd 1981). The latter site is characterized by soft, somewhat acid water and is the only major *Sphagnum* bog in Iowa.

MATERIALS AND METHODS

Four areas were selected for study. The first was a wet depression at the top of the swale, the second a *Sphagnum* polster about 5 M downslope from the upper edge of the swale, the third a *Polytrichum* polster 3 M further downslope, and the fourth a region of slowly flowing water at the bottom of the swale.

I sampled the site 6 times at approximately 2-week intervals from 27 March to 18 June 1971. In addition to samples for diatom analysis, I took water samples for chemical analysis from each of the four areas whenever conditions allowed. The collection period began when the sampling areas were free from ice and ended when growth of tall vascular plants completely shaded the lower collection areas.

Chemical analyses were made with a Hach model DR-EL portable water testing kit. Diatoms were prepared for study using the hydrogen peroxide method of Van der Werff (1955), then mounted in Hyrax medium. To determine relative abundance of the taxa a single count of 300 valves was made from each of my samples plus the 1 collected by Crum on 19 July 1970. At least 1 slide from each sample was exhaustively searched for rare taxa.

RESULTS

Chemical and physical data

Chemical and physical data are recorded in Table 1.

Table 1 *Observed ranges of chemical and physical parameters of sample sites from March 27 to June 18.*

	Wet Depression	*Sphagnum* Polster	*Polytrichum* Polster	Swale Bottom
temperature (C)	12.0-21.5	0.0-17.5	0.0-17.0	0.0-17.0
pH	6.2-6.5	5.8-6.8	5.0-6.5	6.5-6.7
total hardness (as ppm $CaCO_3$)	16-50	12-32	10-20	22-60
sulfate (ppm)	0-9	0-5	2-7	2-8
dissolved silica (ppm)	1.7-1.9	0.0-3.0	0.0-3.5	0.0-4.0
total iron (ppm)	0.8-1.8	0.1-1.3	0.2-1.4	0.3-1.0
nitrate (ppm)	0-0	0-0	0-0	0-0
orthophosphate	0.1-0.4	0.1-0.4	0.1-0.4	0.1-2.4

Systematic section

I have used a number of symbols and abbreviations. Names preceded by an exclamation point (!) are taxa listed by Dodd (1971) as widespread in Iowa. Those marked with an asterisk (*) were also found in the Pilot Knob Bog. The reference used in making the identification is listed after the abreviation CR. Following the critical reference (CR) I have noted, in parentheses, the abundance of the taxon in the 4 sample areas. The sample areas are identified by these codes: D = wet depression, SP — *Sphagnum* polster, P = *Polytrichum* polster and SW — swale bottom. The abundance codes are: Trace (T) = present but did not occur in the counts, Rare (R) = 1-5 valves/300, Uncommon (U) = 6-20 valves/300, Common (C) = 21-50 valves/300 and Abundant (A) = more than 50 valves/300. If there is no notation for an area, the taxon was not found in it. The highest and lowest values recorded during the sampling period are listed.

Although most of the taxa found in the Sand Prairie are described in commonly available references, a few are not. For these I have added a brief statement of the dimensions of the valve and illustrated it in Figure 1. The dimension statement and figure reference follow the abundance statement.

The following taxa were found in the Sand Prairie:

Achnanthes

! *A. exigua* v. *heterovalva* Krasske; CR: Patrick and Reimer 1966; (SW:T).

! *A. lanceolata* (Bréb.) Grun. v. *lanceolata;* CR: Patrick and Reimer 1966; (SP:T, SW:T).

!* *A. lanceolata* v. *dubia* Grun.; CR: Patrick and Reimer 1966; (SW:

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U-C).

Caloneis

! *C. bacillum* (Grun.) Cl. v. *bacillum;* CR: Patrick and Reimer 1966; (SW:T).

!**C. lewisii* v. *inflata* (Schultze) Patr.; CR: Patrick and Reimer 1966; (SW:T).

!**C. ventricosa* v. *truncatula* (Grun.) Meist.; CR: Patrick and Reimer 1966; (SW:T, D:T).

Cocconeis

! *C. pediculus* Ehr. v. *pediculus;* CR: Patrick and Reimer 1966; (SP:T).

Cymbella

!**C. aspera* (Ehr.) H. Perag. v. *aspera;* CR: Patrick and Reimer 1975; (SW:T).

!**C. cuspidata* Kütz. v. *cuspidata;* CR: Patrick and Reimer 1975; (SW:T).

**C. hauckii* V.H. v. *hauckii;* CR: Patrick and Reimer 1975; (SW:T).

!**C. minuta* v. *pseudogracilis* (Choln.) Reim.; CR: Patrick and Reimer 1975; (SP:T-U, P:T-R, SW:T-U, D:T-U).

C. minuta v. *silesiaca* (Bleisch ex Rabh.) Reim.; CR: Patrick and Reimer 1975; (SP:T-U, P:T-U, SW:R-C, D:T-C).

**C. naviculiformis* Auers. v. *naviculiformis;* CR: Patrick and Reimer 1975; (SW:T-U, D:T).

Diatoma

! *D. vulgare* Bory v. *vulgare;* CR: Patrick and Reimer 1966; (P:T).

Diploneis

! *D. oblongella* (Naeg. ex Kütz.) Ross v. *oblongella;* CR: Patrick and Reimer 1966; (SP:T-R, P:T, SW:T-R, D:T-U).

Epithemia

! *E. adnata v. proboscidea* (Kütz. Patr.; CR: Patrick and Reimer 1975; (SW:T).

Eunotia

E. arcus v. *bidens* Grun.; CR: Patrick and Reimer 1966; (P:T-U, SW:T-U, D:T).

!**E. curvata* (Kütz.) Lagerst. v. *curvata;* CR: Patrick and Reimer 1966; (SP:T-U, P:R-A, SW:U-C, D:U-A).

E. exigua (Bréb. ex Kütz.) Grun. v. *exigua;* CR: Patrick and Reimer 1966; (SP:R-C,P:R-U, SW:T-R, D:T-U).

**E. flexuosa* Bréb. ex Kütz. v. *flexuosa;* CR: Patrick and Reimer 1966; (SW:T, D:T).

**E. maior* (W.Sm.) Rabh. v. *maior;* CR: Patrick and Reimer 1966; (SW:T).

E. praerupta v. *bidens* (Ehr.) Grun.; CR: Patrick and Reimer 1966. (SW:T).

E. septentrionalis Oestr. v. *septentrionalis;* CR: Patrick and Reimer 1966; (SP:T-R, P:T-U, SW:T-U, D:T).

E. tenella (Grun.) Cl. v. *tenella;* CR: Patrick and Reimer 1966; (P:T).

Fragilaria

!**F. virescens* Ralfs v. *virescens;* CR: Patrick and Reimer 1966; (P:T-R, SW:R-C).

Frustulia

F. rhomboides v. *saxonica* (Rabh.) De T.; CR: Patrick and Reimer 1966; (SP:T-R, P:T-R, SW:T, D:T-U).

F. rhomboides v. *saxonica* f. *undulata* Hust.; CR: Hustedt 1930; (SP:T, P:T, SW:T, D:T-U).

! *F. vulgaris* (Thwaites) De T. v. *vulgaris;* CR: Hustedt 1930; (SP:T, SW:T).

Gomphonema

!**G. acuminatum* Ehr. v. *acuminatum;* CR: Patrick and Reimer 1975; (SW:R-U).

! *G. affine* Kütz. v. *affine;* CR: Patrick and Reimer 1975; (SW:T, D:T-U).

!**G. affine* v. *insigne* (Greg.) Andrews; CR: Patrick and Reimer 1975; (SW:T).

!**G. angustatum* (Kütz.) Rabh. v. *angustatum;* CR: Patrick and Reimer 1975; (SP:T-R, P:T, SW:T-U, D:T-U).

!**G. parvulum* (Kütz.) Kütz. v. *parvulum;* CR: Patrick and Reimer 1975; (SP:T-U, P:T-R, SW:U-C, D:T-C).

Hantzschia

!**H. amphioxys* f. *capitata* O. Muell.; CR: Hustedt 1930; (SP:U-C, P:T-C, SW:T-R, D:T-A).

! *H. amphioxys* v. *maior* Grun.; CR: Hustedt 1930; (SW:T,D:T).

Melosira

! *M. italica* (Ehr.) Kütz. v. *italica;* CR: Hustedt 1930; (P:T, SW:R-U). This taxon showed much of its great reported variability including presence of statospores.

M. roeseana Rabh. v. *roeseana;* CR: Hustedt 1930; (SW:T).

Meridion

!**M. circulare* v. *constrictum* (Ralfs) V.H.: CR: Patrick and Reimer 1966; (P:T-R, SW:T-C, D:T).

Navicula

! *N. amphibola* Cl. v. *amphibola;* CR: Patrick and Reimer 1966; (SW:T).

N. arvensis Hust. v. *arvensis;* CR: Patrick and Reimer 1966; (SW:T).

**N. begeri* Krasske v. *begeri;* CR: Hustedt 1962; (SP:T, P:T, SW:T, D:T-C); Dimensions: length 10-16 μm; width 2-2.5 μm; striae around 20/10 μm. Figure 1 G.

! *N. contenta v. biceps* Arnott; CR: Hustedt 1930; (SW:T).

!**N. cryptocephala* Kütz. v. *cryptocephala;* CR: Patrick and Reimer 1966; (SW:R-U).

!**N. cuspidata* (Kütz.) Kütz. v. *cuspidata;* CR: Patrick and Reimer 1966; (SW:T).

!**N. elginensis* (Greg.) Ralfs v. *elginensis;* CR: Patrick and Reimer 1966; (SP:T-R, P:T, SW:U-C, D:T).

**N. hambergii* Hust. v. *hambergii;* CR: Patrick and Reimer 1966; (SP:T-R, P:T-R, SW:T, D:T).

N. hassiaca Krasske v. *hassiaca;* CR: Hustedt 1930; (SP:T-R, P:T, SW:T-R, D:T-C).

! *N. heufleri* Grun. v. *heufleri;* CR: Patrick and Reimer 1966; (SW:T).

**N. ignota* Krasske v. *ignota;* CR: Lund 1946; (SW:T); dimensions: length 13-19 μm; width 4-5 μm; striae 15-18/10 μm; Figure 1 D.

N. ignota v. *palustris* (Hust.) Lund; CR: Lund 1946; (SW:T); dimensions: length 13-23.5 μm; width 5-6 μm; striae 15-18/10 μm; Figure 1 E.

N. insociabilis Krasske v. *insociabilis;* CR: Hustedt 1962; (SW:T); dimensions: length 10-22 μm; width 4.5-7 μm; striae 20-25/10 μm. Figure 1 C.

N. lapidosa Krasske v. *lapidosa;* CR: Hustedt 1930; (SP:T-R, P:T-U, SW:T-R, D:T-R).

!**N. mutica* Kütz v. *mutica;* CR: Patrick and Reimer 1966; (SP:U-C, P:U-C, SW:T-U, D:T-C).

! *N. mutica* v. *undulata* (Hilse) Grun.; CR: Patrick and Reimer 1966; (SP:T).

!**N. nigrii* De Notaris v. *nigrii;* CR: Begres 1971; (SP:U-A, P:C-A, SW:U-A, D:T-A); dimensions: length 5.5-12 μm; width 2.5-3 μm; striae 30-36/10 μm. Figure 1 B.

N. placenta Ehr. v. *placenta;* CR: Patrick and Reimer 1966; (SP:T, P:T-U, SW:T-U, D:T-C).

N. poconoensis Patr. v. *poconoensis;* CR: Patrick and Reimer 1966; (SP:T, P:T-R, SW:T-R, D:T-U).

!**N. pupula* (Greg.) Kütz. v. *pupula;* CR: Patrick and Reimer 1966; (P:T-R, SW:U, D:T).

!**N. pupula* v. *rectangularis* (Greg.) Grun.; CR: Hustedt 1930;

(P:T, SW:T, D:T).

! *N. radiosa* Kütz. v. *radiosa;* CR: Patrick and Reimer 1966; (SW: R-C).

!**N. seminulum* Grun. v. *seminulum;* CR: Hustedt 1930; (SP:U-C, P:U-C, SW:U-C, D:T-U).

N. subfasciata Patr. v. *subfasciata;* CR: Patrick and Reimer 1966; (SW:T, D:T).

N. terrestris v. *relicta* (McCall) Lund; CR: Lund 1946; (SP:T); dimensions: length 13-45 μm; width 4-10 μm; striae 13-18/10 μm at midvalve, 22-25/10 μm at ends. Figure 1 F.

Neidium

! *N. affine* v. *undulatum* (Grun.) Cl.; CR: Patrick and Reimer 1966; (SW:T).

**N. bisulcatum* (Lagerst.) Cl. v. *bisulcatum;* CR: Patrick and Reimer 1966; (SP:T-R, P:T-R, SW:T, D:T-A).

**N. bisulcatum* v. *subundulatum* (Grun.) Reim.; CR: Patrick and Reimer 1966; (P:T).

N. hankensis v. *elongatum* Skv.; CR: Stoermer 1963; (P:T, SW:T); dimensions: length 32-60 μm; width around 10 μm; striae 19-22/10 μm. Figure 1 K.

!**N. iridis* (Ehr.) Cl. v. *iridis;* CR: Patrick and Reimer 1966; (SW:T).

Nitzschia

!**N. amphibia* Grun. v. *amphibia;* CR: Hustedt 1930; (SW:T).

! *N. denticula* Grun. v. *denticula;* CR: Hustedt 1930; (SW:T).

!**N. frustulum* v. *perminuta* Grun.; CR: Hustedt 1930; (SP:T, P:T, SW:T, D:T).

N. ignorata Krasske v. *ignorata;* CR: Hustedt 1930; (SW:T).

!**N. obtusa* v. *brevissima* Grun.; CR: Lund 1946 (as *N. parvula* f. *terricola* Lund); (SP:C-A, P:U-A, SW:T-U, D:T-C); dimensions (including Sand Prairie specimens): length 24-125 μm; width 4.5-5 μm; keel puncta 5.5-9/10 μm; striae around 40/10 μm. Figure 1 L.

!**N. palea* (Kütz.) W.Sm. v. *palea;* CR: Hustedt 1930; (SP:T-C, P:T-U, SW:R-C, D:T-A).

! *N. tryblionella* v. *debilis* (Arnott) A. Mayer; CR: Hustedt 1930; (SP:T, P:T, SW:T, D:T).

Pinnularia

**P. abaujensis* (Pant.) Ross v. *abaujensis;* CR: Patrick and Reimer 1966; (SP:T-U, P:T-C, SW:R-U, D:T-U).

**P. abaujensis* v. *subundulata* (A. Mayer ex Hust.) Patr.; CR: Patrick and Reimer 1966; (P:T, SW:T).

P. absita Hohn and Hellerman v. *absita;* CR: Hohn and Hellerman 1963; (SP:T, P:T, D:T-C); dimensions: length 37-50 μm; width 6-7.8 μm; striae around 10/10 μm. Figure 1 J.

!**P. acrosphaeria* W.Sm. v. *acrosphaeria;* CR: Patrick and Reimer 1966; (SP:T-U, P:T-R, SW:T-R, D:T).

**P. biceps* f. *peterseni* Ross; CR: Patrick and Reimer 1966; (P:T, D:T).

!**P. borealis* Ehr. v. *borealis;* CR: Patrick and Reimer 1966; (SP:T, SW:T, D:T).

! *P. brebissonii* (Kütz.) Rabh. v. *brebissonii;* CR: Patrick and Reimer 1966; (SP:T, P:T, SW:T, D:T).

P. divergens v. *parallela* (Brun) Patr.; CR: Patrick and Reimer 1966; (P:T, D:T).

P. divergentissima (Grun.) Cl. v. *divergentissima;* CR: Patrick and Reimer 1966; (D:T).

**P. gentilis* (Donk.) Cl. v. *gentilis;* CR: Patrick and Reimer 1966; (P:T, SW:T, D:T).

P. instita Hohn and Hellerman v. *instita;* CR: Hohn and Hellerman 1963; (SP:T, P:T, SW:T, D:T); dimensions: length 36-52 μm; width 6.5-8.3 μm; striae around 10/10 μm. Figure 1 I.

!**P. intermedia* (Lagerst.) Cl. v. *intermedia;* CR: Lund 1946, Patrick and Reimer 1966; (SP:U-A, P:T-C, SW:T-R, D:T-C); Lund combines this taxon with *P. obscura* Krasske, while Patrick and Reimer separate the two. Lund's concept seemed the better fit for the present material.

P. leptosoma Grun. v. *leptosoma;* CR: Hustedt 1930; (SP:T-U, P:T-R, SW:T-R, D:T-U).

**P. mesogongyla* Ehr. v. *mesogongyla;* CR: Patrick and Reimer 1966; (SP:T, P:T, SW:T, D:T).

**P. mesolepta* (Ehr.) W. Sm. v. *mesolepta;* CR: Patrick and Reimer 1966; (SP:T, P:T, D:T).

**P. nobilis* (Ehr.) Ehr. v. *nobilis;* CR: Patrick and Reimer 1966; (P:T, SW:T, D:T).

!**P. stomatophora* (Grun.) Cl. v. *stomatophora;* CR: Patrick and Reimer 1966; (SP:T-U, P:T-R, SW:T-R, D:T-U). The present populations are variable in morphology: ends may be broadly rounded to rostrate, margins of valve straight to weakly undulate and lunate areas strongly expressed to essentially absent.

!**P. streptoraphe* Cl. v. *streptoraphe;* CR: Patrick and Reimer 1966; (SW:T, D:T).

**P. subcapitata* Greg. v. *subcapitata;* CR: Patrick and Reimer 1966; (SP:T-R, P:T-U, SW:T-R, D:T-A).

!**P. viridis* (Nitz.) Ehr. v. *viridis;* CR: Patrick and Reimer 1966; (SP:T-R, P:T-R, SW:T-R, D:T-U).

**P. viridis* v. *commutata* (Grun.) Cl.; CR: Patrick and Reimer 1966; (D:T).

Rhopalodia

!**R. gibba* (Ehr.) O. Muell. v. *gibba;* CR: Patrick and Reimer 1975; (SP:T, SW:T).

Stauroneis

!**S. anceps* Ehr. v. *anceps;* CR: Patrick and Reimer 1966; (SP:T-R, P:T-R, SW:R, D:T-U).

**S. anceps* f. *gracilis* Rabh.; CR: Patrick and Reimer 1966; (P:T).

S. borrichii (Peters.) Lund v. *borrichii;* CR: Lund 1946; (D:T); dimensions: length 10-23 μm; width 3-4 μm; striae 19-25/10 μm near midvalve. Figure 1 A.

S. javanica (Grun.) Cl. v. *javanica;* CR: Hustedt 1959; (SW:T); dimensions: length 100-260 μm; width 25-44 μm; striae 11-14/10 μm. Figure 1 H.

!**S. phoenicenteron* (Nitz.) Ehr. v. *phoenicenteron;* CR: Patrick and Reimer 1966; (SW:T, D:T).

!**S. phoenicenteron* f. *gracilis* (Ehr.) Hust.; CR: Patrick and Reimer 1966; (SW:T).

Surirella

!**S. angusta* Kütz. v. *angusta;* CR: Hustedt 1930; (SP:T).

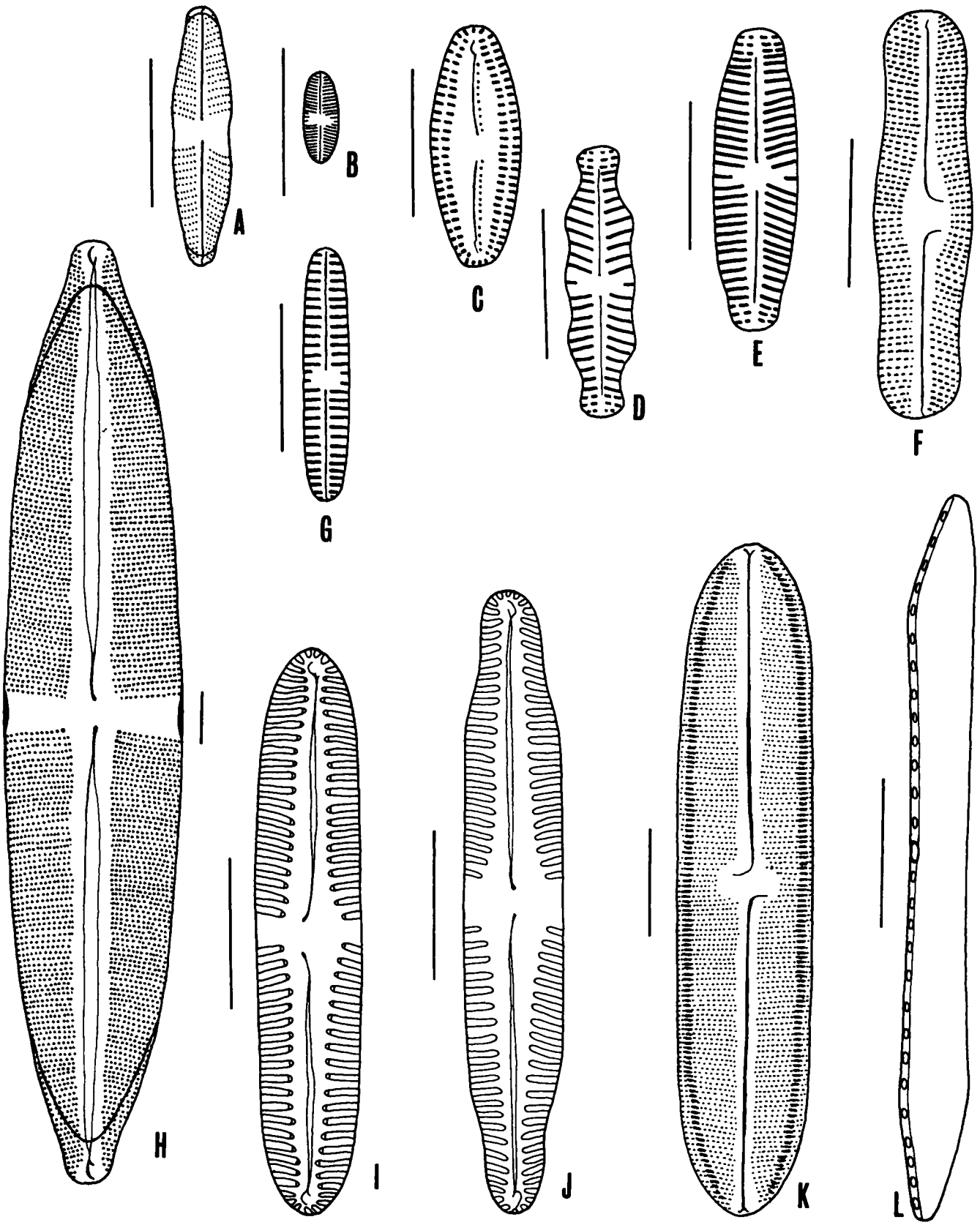
**S. delicatissima* Lewis v. *delicatissima;* CR: Hustedt 1930; (P:T-R, SW:T-R, D:T-R).

Synedra

! *S. acus* v. *delicatissima* (W.Sm.) Grun.; CR: Hustedt 1930; (SW:T). The present specimens are more linear than those illustrated by Hustedt.

Fig. 1. *Some uncommon diatoms found in the Mark Sand Prairie*

A. Stauroneis borrichii, *B.* Navicula nigrii, *C.* Navicula insociabilis, *D.* Navicula ignota, *E.* Navicula ignota *v.* palustris, *F.* Navicula terrestris *v.* relicta, *G.* Navicula begeri, *H.* Stauroneis javanica, *I.* Pinnularia instita, *J.* Pinnularia absita, *K.* Neidium hankensis *v.* elongatum, *L.* Nitzschia obtusa *v.* brevissima. *All magnification scales are 10 μm.*


A
B
C
D
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L

S. ulna v. *amphirhynchus* (Ehr.) Grun.; CR: Patrick and Reimer 1966; (SW:T).

DISCUSSION

I found 107 species and subspecific taxa representing 22 genera in the Mark Sand Prairie. Of these, 59 were reported by Dodd (1971) as widespread in Iowa. Of the remaining 48, 15 are new records for the state: *Cymbella minuta* v. *silesiaca, Eunotia exigua* v. *exigua, E. praerupta* v. *bidens, E. septentrionalis, Frustulia rhomboides* v. *saxonica, F. rhomboides* v. *saxonica* f. *undulata, Navicula placenta, N. poconoensis, N. subfasciata, N. terrestris* v. *relicta, Pinnularia divergens* v. *parallela, P. divergentissima, P. absita, P. instita* and *Stauroneis javanica*. In addition, it is possible that *S. javanica* is a new record for the United States. Several of the remaining taxa in this list, particularly *C. minuta* v. *silesiaca, P. absita* and *P. instita,* may have been considered to be part of different taxa by other authors.

Though not similar physically, the Mark Sand Prairie and the Pilot Knob Bog are similar in having soft, somewhat acid water (Christensen 1981 in press). Of the 107 diatom taxa I found in the Sand Prairie, 58 have also been found in the Pilot Knob Bog (Christensen 1969, 1976, 1981 in press; Dodd 1981 in press). Three additional species were represented in the 2 sites by different varieties. With 4 exceptions the same genera were found in both sites: *Diatoma* was probably accidental in the Sand Prairie; *Amphora* was a minor component in the Pilot Knob flora but was absent from the Sand Prairie, *Diploneis* was a minor component of the Sand Prairie flora but was absent from Pilot Knob; *Frustulia* was an important minor component of the Sand Prairie flora but, surprisingly, absent from Pilot Knob. Both sites had large numbers of *Eunotia* and *Pinnularia* species as would be expected for acid, soft water habitats. The near absence of *Cocconeis* and *Rhopalodia* from both sites (only a few valves of each were encountered), despite the presence of suitable substrates for colonization, supports Lowe's (1974) conclusion that these genera are alkaliphilic.

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